CLAIMS

1. Electronic device (30) for a mechanical seal (10, 20) of a pump or a process machine (11, 21), said mechanical seal comprising two coupled surfaces, a surface rotating and integral with a shaft and another surface stationary and integral with the pump or the process machine in which the shaft is inserted, said two surfaces being kept in contact by two combined forces, a mechanical force generated by springs and an hydraulic force generated by a pressure of a fluid, said surfaces needing a pressurisation line (32) connected through a pressure regulation element (302) to a supply line for a suitable fluid (31), said electronic device automatically and continuously regulating, during normal operation, the pressure inside the mechanical seal (303) depending on a pressure (304) in the pump delivery line or inside the process machine, in order to keep constant an optimum difference (305) between an internal pressure of said mechanical seal and the pressure of said pump or process machine.

2. Electronic device (30) according to claim 1, characterised in that said pressure regulating element (302) is preceded by a minimum pressure switch (301), said pressure regulating element being further driven by a converter (309) that received commands from an regulating algorithm (308).

3. Electronic device (30) according to claim 2, characterised in that said regulating algorithm (308) receives data from a comparator (307) that compares a desired value, output from a block (306), with a measured value, output from a block (303).

4. Electronic device (30) according to claim 3, characterised in that said desired value is computed by

an adder (306) summing to a process pressure, detected by a pressure transmitter (304), an optimum pressure difference (305) imposed or suggested by a manufacturer of said mechanical seal (10, 20).

5. Electronic device (30) according to claim 3, characterised in that said measured value is detected by a suitable transducer (303).

6. Electronic device (30) according to claim 3, characterised in that said regulating algorithm (308) is temporarily disabled by a microprocessor that controls said electronic device, forcing a fixed configuration of said pressure regulating element (302), without necessarily depending on desired and measured values output from block (307).

7. Electronic device (30) according to claim 1, characterised in that a fluxing line (33) is provided as input to said electronic device, coming from said mechanical seal (10, 20) and connected to a vent line (34) after passing through a flow-rate regulating element (310).

8. Electronic device (30) according to claim 7, characterised in that said flow-rate regulating element (310) is realised with a multivalve that has a series of precision nozzles that are pre-calibrated and mutually arranged in parallel.

9. Electronic device (30) according to claim 8, characterised in that for each one of said nozzles a fluxing flow-rate is known a priori for every possible pressure value, said device adjusting through a microprocessor a flow-rate on said fluxing line (33) by controlling an opening or closing of said nozzles depending on a variable pressure measure, detected by a transducer (303), and on a desired flow-rate value

imposed or suggested by a manufacturer of said mechanical seal (10, 20) or temporarily requested by a specific control procedure.

10. Electronic device (30) according to claim 7, characterised in that said flow-rate regulating element (310) is realised with a proportional valve of the two-way type fed-back by a suitable flow-rate meter, said feed-back being realised by a microprocessor in order to guarantee on said fluxing line (33) a measured flow-rate value as imposed or suggested by a manufacturer of said mechanical seal (10, 20) or as temporarily requested by a specific control procedure.

11. Electronic device (30) according to claim 1, characterised in that said electronic device periodically performs an algorithm for an automatic and systematic integrity check of said mechanical seal (10, 20) based on detection and evaluation of actual pressure leakage.

12. Electronic device (30) according to claim 11, characterised in that during an integrity check procedure a null flow-rate through said flow-rate regulating element (310) and a maximum pressure through said pressure regulating element (302) are initially and temporarily imposed.

13. Electronic device (30) according to claim 2 and 12, characterised in that afterwards, by temporarily disabling said regulating algorithm (308), said pressure regulating element (302) is inhibited thereby insulating said mechanical seal (10, 20) from said supply line of a suitable fluid (31) and avoiding an automatic compensation of possible pressure leakage on said pressurisation line (32).

14. Electronic device (30) according to claim 13, characterised in that once having pressurised and

insulated said mechanical seal (10, 20), a possible time variation of the pressure measure measured by the transducer (303) is evaluated in a prefixed time, generating an alarm situation when the detected pressure leakage in a known time is greater than a preset value.

15. Electronic device (30) according to claim 14, characterised in that, at the end of said integrity check and without such alarm situation, said electronic device is programmed to automatically restore the usual pressure and flow-rate regulations.

16. Electronic device (30) according to claim 1, characterised in that in order to monitor possible alarms, anomalies and malfunctions, said electronic device is prearranged for acquiring external signals coming from possible minimum level switches and fluxstats (316, 318) and maximum level switches and fluxstats (315, 317), generating possible alarms for low level, high level, low flow and high flow.

17. Electronic device (30) according to claim 16, characterised in that it is arranged for managing other external input and output signals, necessary or useful for implementing further functionalities and for integrating other possible apparata or automation systems.

18. Electronic device (30) according to claim 17, characterised in that an input signal (311) is a contact prearranged to recognise when said mechanical seal (10, 20) is operating, realising an automatic activation of operating and diagnostics functionalities in addition to a count and a recording of actual operating hours.

19. Electronic device according to claim 18, characterised in that it counts the actual operating hours of said mechanical seal (10, 20) classifying them

also depending on different seal pressurisation and process pressurisation.

20. Electronic device (30) according to claim 17, characterised in that an output signal (312) is a contact prearranged for signalling the existence of possible current alarm situations and that an input signal (313) is a contact prearranged for a remote recognition and a reset of possible alarm or lock situations, realising through said output and input signals an integration of command and controls of said electronic device with those of other possible apparata or automation systems.

21. Electronic device (30) according to claim 17, characterised in that an output signal (314) is a prearranged "Watch Dog" contact, managed as pulse frequency output, allowing other possible apparata a monitoring of a correct operation of said electronic device.

22. Electronic device (30) according to claim 21, characterised in that it is equipped with a display (319) and a keyboard (320), for reconfiguring operating parameters and for displaying current and historical available data, and with a mass storage (321), for recording these data.

23. Electronic device according to claim 22, characterised in that said mass storage (321) is of the solid state type and cannot be deleted by a user, allowing a rigorous data recording in order to have such an historical trace as to document, certify and validate life, operating modes and diagnostic conditions of said mechanical seal (10, 20).

24. Electronic device (30) according to claim 2, characterised in that it acquires a signal from said minimum pressure switch (301), generating a possible low

pressure alarm.

25. Electronic device (30) according to claim 1, characterised in that said pressure regulating element (302) is realised with a proportional valve of the three way type.

26. Electronic device (30) according to claim 1, characterised in that said pressure regulating element (302) is realised by employing two proportional valves of the two way type, one valve in order to be able to increase the pressure of said pressurisation line (32) through a divided connection to said supply line of a suitable fluid (31), another valve to decrease the pressure through a divided connection to a vent line (34).

27. Electronic device (30) according to claim 1, characterised in that a transducer (303) measures the pressure in the pressurisation line (32) output from said electronic device and then also measures the pressure inside said mechanical seal (10, 20).

28. Electronic device (30) according to claim 1, characterised in that a pressure transmitted (304) is able to detect the pressure in the delivery line of said pump or the pressure inside said process machine in which said mechanical seal (10, 20) is assembled.

29. Electronic device (30) according to claim 3, characterised in that said regulating algorithm (308), depending on the proportional, integral, derivative component or other types of error between measured value and desired value, decides during normal operation how to control said pressure regulating element (302).

30. Electronic device (30) according to claim 2, characterised in that said converter (309) operates a suitable electric driving of said pressure regulating

element (302).

31. Electronic device according to claim 1, characterised in that it comprises at leas one suitably-programmed microprocessor.

32. Electronic device according to claim 1, characterised in that it is multifunctional and such that all functional, diagnostic and control aspects related to a mechanical seal (10, 20) are concentrated, related and managed by a single apparatus composed of said electronic device.

33. Control and management process for an electronic device (30) according to claim 1, characterised in that it comprises the following sequential steps that are cyclically performed: switch-on step (600) performed only the first time, operation enabling checking step (601), anomalies checking step (602) performed only in case of positive check in said step (601), integrity control request checking step (603) performed only in case of no anomalies detected in said step (602), pressure regulating step (604) performed only in case of negative check in said step (603), fluxing need checking step (605), flow-rate regulating step (606) bypassed in case of negative check in said step (605), operating hours counting step (607), data displaying and recording step (608), interfacing step with other possible systems (609).

34. Control and management process according to claim 33, characterised in that it comprises the following sequential steps that are cyclically performed only in case of negative check in said step (601): configuration modify request checking step (612), system reconfiguring step (613) bypassed in case of negative check in said step (612), command resetting step (614),

said data displaying and recording step (608), said interfacing step with other possible systems (609).

35. Control and management process according to claim 33, characterised in that it comprises the following sequential steps that are cyclically performed only in case of positive check in said step (603): integrity checking step (610), alarm managing step (611) bypassed in case of no alarms detected in said step (610), said operating hours counting step (607), said data displaying and recording step (608), said interfacing step with other possible systems (609).

36. Control and management process according to claim 33, characterised in that it comprises the following sequential steps that are cyclically performed only in case of anomalies detected in said step (602): alarm managing step (611), said operating hours counting step (607), said data displaying and recording step (608), said interfacing step with other possible systems (609).